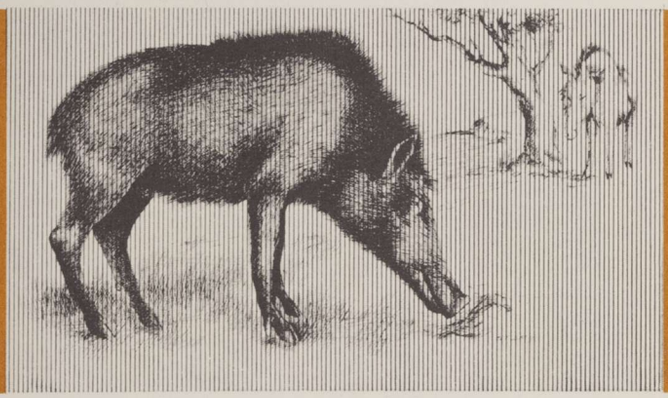
BULLETIN

number 1 April, 1960

OF THE TEXAS MEMORIAL



Mylohyus nasutus

Long-nosed Peccary of the Texas Pleistocene

by Ernest L. Lundelius, Jr.

MUSEUM

The Museum of The University of Texas 24th & Trinity · Austin 5

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TEXAS MEMORIAL MUSEUM
the museum of the university of texas
24TH & TRINITY • AUSTIN 5, TEXAS

Foreword

An important responsibility of museums is the dissemination of knowledge, accomplished not only by exhibits, but also by popular and technical publications. The BULLETIN OF THE TEXAS MEMORIAL MUSEUM initiates a new technical series and fills, consequently, a long-felt need. The BULLETIN will be published occasionally, as manuscripts become available and as their publication becomes feasible. The primary purpose of the BULLETIN is the publication of the results of Museum-sponsored research and investigation, of which this first number is a good example. But other manuscripts describing or interpreting non-Museum sponsored investigations will be considered for publication, particularly if they deal with the natural or social history of Texas. As a technical publication the BULLETIN is written by and for specialists. Nevertheless, every effort will be made to reduce technical jargon and terminology to a minimum in order that interested laymen may also enjoy and derive benefit from it.

W. W. NEWCOMB, JR.
Director
APRIL, 1960

Acknowledgments

THE author is indebted to a number of persons for assistance and the loan of material. Dr. W. W. Newcomb, Jr., Director of the Texas Memorial Museum, made the Friesenhahn material available for study and gave invaluable aid in the preparation of the manuscript. The author also wishes to thank Mrs. Rachel Nichols of the American Museum of Natural History, Dr. C. L. Gazin of the U. S. National Museum, Mr. S. J. Olsen of the Florida Geological Survey, and Dr. Theodore Downs of the Los Angeles County Museum for permission to study material in the collections of their respective institutions. Dr. Richard Konizeski generously made available his unpublished data on variation in Recent peccaries. Mr. John E. Guilday of the Carnegie Museum kindly made available casts of the type of *Mylohyus pennsylvanicus* (Leidy). Dr. John A. Wilson offered valuable criticism of the manuscript. The cover figure and figures 1, 2, 3, and 8 were drawn by Mr. Hal M. Story, Exhibits Chief and Artist of the Texas Memorial Museum. The skeleton which is on exhibit in the Texas Memorial Museum was mounted by Mr. Otto C. Schoen, Museum Preparator. A grant from the Geology Foundation, The University of Texas, made it possible to study material in other institutions.

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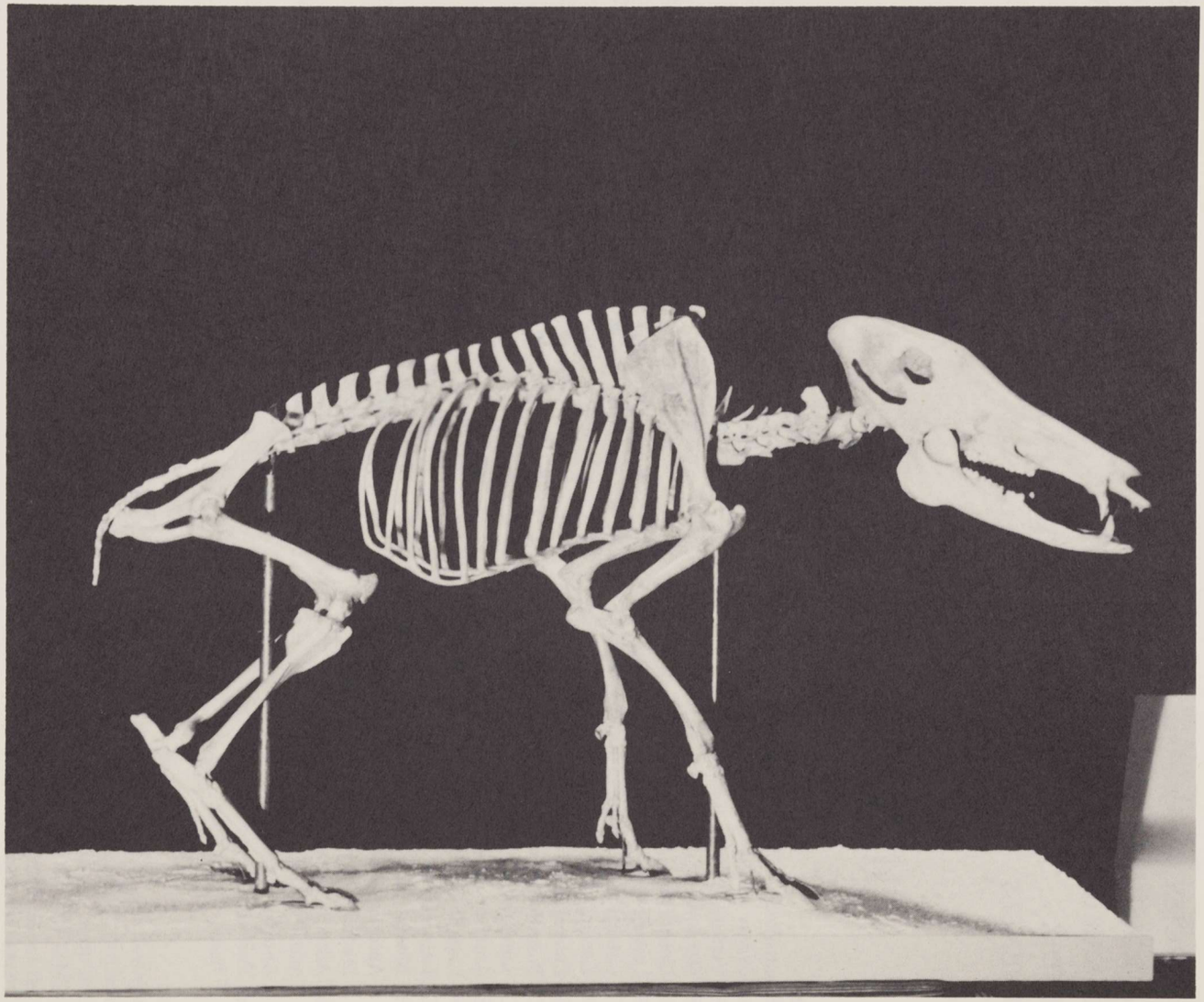

PLATE I Mounted skeleton of *Mylohyus nasutus*

Introduction

In the course of excavating the Friesenhahn Cave in Bexar County, Texas, in 1949 and 1951, the Texas Memorial Museum recovered numerous remains of the long-snouted peccary *Mylohyus nasutus*. This material consists of one almost complete skeleton (TMM 933–3232),[1] and in addition six humeri, three femora, three scapulae, four radii and ulnae, and numerous smaller bones. Mandibular fragments indicate the presence of at least five individuals, four of which are adult, the other a juvenile. This material is described in the first part of this paper. The second part is a review of the species of this genus.

Although a detailed account of the stratigraphy of the cave is in preparation, a brief summary will be given here (field notes by Glen L. Evans on deposit, Texas Memorial Museum). Four stratigraphic units can be recognized. They are designated Zones 1 through 4 from bottom to top. Zone 1 consists of blocks of limestone which have fallen from the roof, iron-stained gravels, and red clay. Zone 2 consists of a laminated, unctuous clay with thin partings of limestone grit. Zone 3 is composed of a carbonaceous clay with dark gray bands. This zone produced most of the bone found in the cave. Zone 4 is a channel fill composed of limestone, flint gravel, and reworked clay. Most of the bones from this zone appear to be reworked from Zones 2 and 3. Some may be younger. *Mylohyus* remains have been found in the three upper zones. The nearly complete articulated skeleton was found in Zone 2.

The age of the deposit is not precisely known. The presence of such species as *Aenocyon dirus*, *Tapirus* sp., *Elephas* sp., *Bison* sp., and many rodents similar to living species indicate a late Pleistocene age, probably a phase or phases of the Wisconsin. Unfortunately, the absence of suitable material for a radiocarbon age determination has made it impossible thus far to check this interpretation.

The nearly complete skeleton is that of a young adult; cranial sutures and epiphyses of the long bones are completely closed, but the teeth are not badly worn. Preservation is very good except for thin-walled bones of the skull and scapula. The ribs have been somewhat deformed.

[1] Abbreviations used are:
AMNH—American Museum of Natural History
USNM—United States National Museum
FGS—Florida Geological Survey
TMM—Texas Memorial Museum
CM—Carnegie Museum

PLATE II

A. Ventral view of skull;

B. Dorsal view of skull, x.6

PLATE III

A. Dorsal view of mandible; B. Lateral view of skull; C. Lateral view of mandible, x.6

The Friesenhahn Remains

Skull

The skull has a long, slender rostrum (Plate II, A,B, and Plate III, B). The top of the cranium is flat with no sagittal crest. The dorsal facial profile is slightly concave as in *Prosthennops,* and thus contrasts with Recent peccaries and *Platygonus.* The sutures are closed as in the adults of other peccaries.

When viewed from above, the braincase is roughly diamond-shaped. It is widest at the posterior edge of the orbits, and narrows rapidly anteriorly to join the snout. Two supraorbital foramina open into facial grooves which extend to the region of the canines in a relatively straight line. There are no branches observable as in *Platygonus* and *Tayassu.*

The zygomatic root and arch are very broad, much more so than in either *Tayassu* or *Platygonus,* and the arch lacks the prominent, rounded, downward-projecting ridge on the ventral edge found in the latter genus. The result is an arch whose ventral border is concave anterior to the glenoid fossa. On the underside of this arch is a depression for the origin of the external masseter muscle. This area is much smaller than that in either *Platygonus* or *Tayassu,* and is definitely separated from a depressed area on the side of the rostrum. In *Tayassu* and *Platygonus* the only hint of a separation of these two areas is a small, roughened ridge on the ventral side of the zygomatic arch. In general the arch is very similar to that of *Prosthennops niobrarensis* (Colbert, 1935).

On the side of the rostrum is an elongated depressed area. Over this area is a shelf formed posteriorly by the jugal and dorsally by the maxilla. This area extends posteriorly on the anterior part of the zygomatic arch to the level of M^3. This part of the skull has been crushed, and it is impossible to determine the exact depth of the area. The infraorbital foramen is located in this area above P^4. The floor of the foramen extends anteriorly as a small shelf to P^2.

The orbit is round and open at the back as in the other peccaries. The postorbital process of the jugal is triangular and ends in a sharp point. The postorbital process of the frontal is a bulbous process unlike that of *Tayassu* or *Platygonus.* These two bony projections were probably joined in life by a ligament as in *Tayassu* to complete the postorbital bar.

The dorsal border of the squamosal, which forms the edge of the temporal fossa, extends in a smooth curve backward and upward from its junction with the jugal to a high, pointed process which forms the anterior border of the external auditory meatus. From this point the posterior edge of the temporal fossa extends downward to form a notch before joining the nuchal crest. A similar situation is encountered in *Tayassu* and *Platygonus.*

The nuchal crest is very similar to that of *Tayassu* and *Platygonus* except that the two sides do not join a sagittal crest at the midline. The supraoccipital area is wider in *Mylohyus* than in *Tayassu* or *Platygonus.*

The occipital condyles are similar to those

of *Tayassu* and *Platygonus*, but they appear to protrude farther posteriorly than in other known tayassuids. Some of this may be owing to the distortion of the skull, but the contours of the bone in the area of the condyles indicate some difference in this character.

The post tympanic process of the squamosal is very elongated (two and one-half times longer than wide) in contrast to the nearly circular shape in other tayassuids. It extends from the external auditory meatus to within an inch of the glenoid fossa.

The oval-shaped glenoid fossa is located directly under the orbit as in *Platygonus*, and in contrast to *Tayassu*. The post glenoid process is poorly developed, resulting in a shallow glenoid fossa. *Platygonus* and *Tayassu* have better developed post glenoid processes and deeper glenoid fossae.

The auditory bullae are more elongated (length = 2 × width) than in other known tayassuids but are otherwise very similar. The ventral end is elongated but does not reach the level of the glenoid fossa as in *Tayassu*. The stylomastoid foramen in *Mylohyus* is formed equally by the bulla and the squamosal and opens into a groove formed jointly by the bulla and the squamosal. In *Tayassu* the stylomastoid foramen opens into a groove in the postero-ventral surface of the squamosal. The bulla forms only a small part of its border (Figure 1).

The hypoglossal foramen is rounded in *Mylohyus* and is located approximately under the midpoint of the occipital condyle. There is no tendency to be divided as in *Tayassu*.

The remainder of the basicranium is missing, but the proportions of the skull as a whole indicate a more elongated condition than is found in other members of the subfamily.

The palate is long and narrow. The tooth rows show a slight bowing which may be due

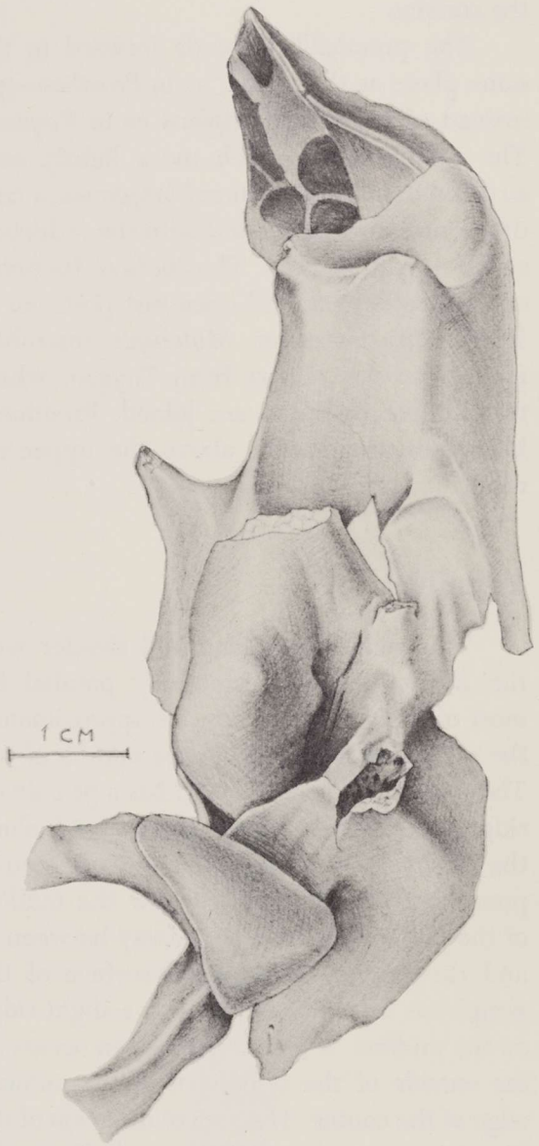

FIGURE 1

Ventral side of basicranium of *Mylohyus nasutus* (TMM 933–3581)

to distortion. Palatal foramina open opposite P^2 into grooves which lead anteriorly toward the canines.

The premaxilla extends forward in the same plane as the palate, as in *Prosthennops*, instead of turning downward as in *Tayassu*. The premaxilla is much more lightly constructed than in *Tayassu* or *Platygonus*, a condition probably associated with the reduction of the upper incisors. The incisive foramina are separate, oval, and open just posterior to I^2. In this character *Mylohyus* resembles *Platygonus* and differs from *Tayassu* where the incisive foramina are joined. Prominent buttresses are present above the upper canines.

Mandible

The mandible is long and slender with the horizontal rami essentially parallel for most of their length. They are approximately the same depth from P_2 to the middle of M_3. The symphysis is narrow and has a prominent ridge on each side which extends back along the diastema to P_2. The mental foramen is prominent and is located below the midline of the jaw approximately halfway between P_2 and the canine. The ventral surface of the symphysis is rounded with only a slight ridge on the midline. A nutritive foramen occurs on the outside of the symphysis at the anterior edge of the canine. The area of insertion of the digastric is represented by a shelf on the postero-ventral edge of the symphysis. There are two small foramina dorsal to this area on the posterior surface of the symphysis.

The ascending ramus is low, the coronoid process is rounded anteriorly and falls off sharply to the condyle. The masseteric fossa is well defined, with a straight ventral border at the level of the tooth row. The ventral part is deep and the ventral border forms a shelf. This is quite different from the condition in *Tayassu* in which the masseteric fossa is very shallow with no shelf formed ventrally.

The ventral margin of the horizontal ramus is straight. The angle of the jaw is rounded and projects well below the horizontal ramus. The ventral part of the outer surface is marked by fine rugosities indicating the area of attachment of the external masseter muscle. These rugosities extend anteriorly onto the side of the horizontal ramus to the level of M_3. A low but sharp outwardly projecting ridge extends around the ventral border of the angle.

The inner surface of the angle is marked by two types of rugosities for the insertion of the pterygoid muscle. Ventrally there are five or six broad, shallow depressions whose long axes lie at right angles to the ventral border. Above these, but eight to ten millimeters below the inferior dental foramen, is a line of fine rugosities. They are well developed at the posterior border of the jaw but become less prominent anteriorly until they die out under the inferior dental foramen.

The inferior dental foramen occurs just below a line drawn between the condyle and M_3. A groove extends posteriorly from the foramen for approximately seventeen millimeters towards the ventral edge of the condyle.

Dentition

Incisors.—There are two upper incisors (I^1 and I^2). Both are round pegs with cross-section diameters of 7 millimeters and 6 millimeters, respectively (Figure 2). They are separated by a gap of 5 millimeters. This condition is the maximum known reduction of the

FIGURE 2

Left upper dentition of *Mylohyus nasutus* (TMM 933–3232)

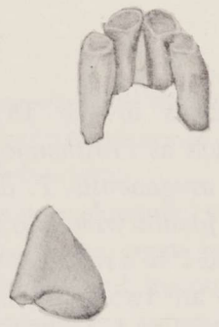

FIGURE 3

Left lower dentition of *Mylohyus nasutus* (TMM 933–3232)

upper incisors in the Tayassuidae. Other species, such as *Prosthennops crassigenis, P. servus, P. oregonensis, P. doellojuradoi,* and *Mylohyus fossilis* which do not have I^3, have not reduced I^1 to a round peg (Colbert 1938).

There are two lower incisors which are extremely procumbent. They extend anteriorly in the plane of the symphysis. I_1 is grooved on the dorsal side, giving a bilobed appearance on the worn surface. I_2 is a simple peg (Figure 3).

Canines.—The canines are smaller, both relatively and absolutely, than in *Platygonus* or *Tayassu.* The unworn upper canines have an elliptical cross section which becomes triangular when the flat wear surface appears on the anterior edge. The inner and outer surfaces are faintly grooved at the base of the enamel but become smoother toward the end.

The lower canines are about the same size as the uppers. They have a triangular cross section and are more strongly curved than the canines in *Platygonus* and *Tayassu.* One or two broad grooves are present on both the inner and outer surface.

Upper premolars.—P^2 is a small subquadrangular tooth with four subequal cusps (protocone, paracone, metacone, and hypocone). The two specimens available show a posterior cingular cusp and one or two anterior cingular cusps. No hypoconule is present. The two specimens differ somewhat in the robustness of the cusps. The larger specimen has larger and more rounded cusps.

P^3 and P^4 are only slightly longer than wide. The maximum width is at the posterior end of the tooth. The protocone, metacone, paracone, and hypocone are the same size and form the four principal cusps. The latter two are separated by a smaller hypoconule and a posterior cingular cusp. The anterior cingular cusp varies in size. The cingula may or may not extend around the outside corners of the teeth.

Upper molars.—M^1 and M^2 are square with the same plan as the two posterior premolars. Unlike the premolars, the hypocone and metacone are not separated by the hypoconule and the posterior cingular cusp. The degree of development of the cingulum varies, but no stylar cusps are found on any of the Friesenhahn material. No distinct paraconule is seen but there is a bulge on the paracone in the position of a paraconule. This is not separated from the paracone by any kind of a fissure.

Only two specimens of M^3 are known from Friesenhahn Cave. Both are widest across the two anterior cusps and taper posteriorly. There is no hint of a paraconule. The heel has one large, centrally located cusp and one small one on the labial side.

Lower premolars.—P_2 is a small, elongated tooth. One of the Friesenhahn specimens (TMM 933–995) has four posterior cusps with the metaconid and hypoconid separated by the metaconulid and hypoconulid. The other two (TMM 933–3232, 933–1450) have only three posterior cusps.

P_3 and P_4 are rectangular teeth with the protoconid, paraconid, hypoconid, and metaconid making up the four principal cusps. The posterior pair are separated by a smaller metaconulid and hypoconulid. The paraconulid is well developed. P_3 is more elongated in some specimens than in others.

Lower molars.—M_1 and M_2 are almost square and follow the same basic plan as the last two lower premolars. The paraconulid is present but is not separated from the paraconid by a deep fissure as in the premolars. The metaconid and hypoconid are not separated by the metaconulid and hypoconulid. As in the upper molars the development of

the cingula vary. M_2 may have a small accessory cusp between the labial pair of cusps. The cingula may or may not extend around the outer corners of the teeth.

M_3 is an elongated tooth with the maximum width across the anterior pair of cusps. The paraconulid is inconspicuous or almost completely missing. A metaconulid is present. The size and number of cusps on the heel is variable, ranging from one large and one small cusp to three large and two small cusps. One specimen (TMM 933–3232) shows two large cusps on the left side and two small cusps on the right.

Deciduous Dentition

The Friesenhahn material includes a part of a left maxilla with dP^{3-4} and unerupted M^1 and portions of right and left mandibles with dP_{2-4} and M_1.

The shape of dP^3 is rectangular with the antero-internal corner somewhat rounded. There are four main cusps and three small cusps on the anterior end. A hypoconule and a posterior cingular cusp are present but do not separate the metacone and hypocone as in the permanent premolars. No accessory cuspule is present between the paracone and metacone as in the dP^3 of *Mylohyus* from the Cumberland Cave, Maryland.

The dP^4 resembles a true molar very closely in both shape and arrangement of the cusps. The hypoconule and posterior cingular cusp are smaller than the hypocone and metacone and do not separate them.

The lower milk molars do not resemble either the true molars or the permanent premolars. The dP_2 is elongated and has two anterior cusps in tandem, the second one being the largest cusp on the tooth. There are four posterior cusps: the hypoconid and metaconid which are the same size, and the metaconulid and hypoconulid which are equal in size but smaller than the other two.

The dP_{3-4} are very elongated rectangular teeth. On dP_3 are four main cusps (protoconid, paraconid, metaconid, and hypoconid) and four accessory cusps on the anterior end. The anterior accessory cusps, two large ones laterally and two small ones, are located anterior and posterior to the junction of the two large ones. On dP_4 the two large anterior cusps are enlarged to the same size as the other four main cusps and give the tooth six equisized cusps. A small paraconulid is present on each tooth.

The deciduous dentition from Friesenhahn Cave resembles the material from Hartman's Cave, Pennsylvania, figured by Leidy (1889) in the size of dP^4. The Cumberland Cave specimen (USNM 8160) is smaller than specimens from Friesenhahn Cave, Conard Fissure, Arkansas, or Hartman's Cave. Gidley (1921) states that the Cumberland Cave material has a more complex cusp pattern than the Hartman Cave specimen. Careful examination of all deciduous teeth available indicates no appreciable difference in this character. In some cases, wear has obliterated any minor cuspules which might have been present.

Vertebrae

Atlas.—The atlas is almost identical to that of *Tayassu* except for size. The foramen for the first spinal nerve and the vertebrarterial canal open together on the dorsal surface. The atlas differs from that of *Platygonus* in having transverse processes which are much more swept back, and a much wider notch when viewed from the top. The anterior

superior border of the neural arch is a more open U than is found in *Platygonus*.

Axis.—The axis is similar to that of *Platygonus* but the neural spine appears to have less posterior curvature. The spine is incomplete in the Friesenhahn specimen and the degree of curvature at the end cannot be determined, but the portion present indicates a straight spine. The posterior side of the neural spine is excavated to form a broad trough as in *Platygonus* and in contrast to *Tayassu* in which a ridge is present. The sides of the posterior trough extend up from the postzygapophyses and possess prominent posterolateral processes which are not present in either *Platygonus* or *Tayassu*. The anterior edge of the neural spine is missing. The median ridge on the ventral surface of the centrum is much stronger in *Mylohyus* than in *Tayassu*.

Cervical vertebrae.—The cervical vertebrae posterior to the axis are very similar to those of *Tayassu*. They differ in the following characters: (1) In the third cervical vertebra of *Mylohyus* the ventral portion of the transverse process is not as well developed as in *Tayassu*. (2) The sixth cervical vertebra of *Mylohyus* has a straight ventral margin and a definite posterior projection on the descending transverse processes. *Tayassu* has a smoothly curved ventral border and no definite posterior process. (3) The neural spine of the seventh cervical vertebra of *Mylohyus* is shorter in proportion to the height of the centrum (2.5 to 1) and is thicker at the base.

Dorsal vertebrae.—There are fourteen dorsal vertebrae which show no difference from either *Tayassu* or *Platygonus*, except for size and the prominence of rugosities, which is probably related to size. The first dorsal vertebra of *Mylohyus* has a ratio of spinal height to centrum of 6.9 to 1 which is almost identical to that of *Tayassu* (6.8 to 1).

Lumbar vertebrae.—The lumbar vertebrae are missing in the mounted specimen (TMM 933–3232) and the number cannot be determined. One isolated lumbar vertebra is known. It appears to be the last of the lumbar series. It differs from the corresponding vertebra of *Tayassu* in having thinner transverse processes without wide, flaring ends, a less well-developed ventral keel on the anterior end of the centrum, and a heavier neural arch at the posterior end. It agrees with *Tayassu* in the rounding of the neural spine posteriorly and the widening and flattening of the centrum posteriorly to match that of the sacrum.

Sacral vertebrae.—The sacrum is not complete but shows evidence of being composed of at least three vertebrae, only one of which articulates with the ilium. A specimen of another species from Arredondo, Florida (*M. fossilis* FGS V-5691) shows five fused sacral vertebrae. It is likely that the Friesenhahn specimen would show the same number if complete. A specimen of *Tayassu* also has five fused sacral vertebrae.

The fusion of the sacral vertebrae in the Friesenhahn specimen is so complete as to make the recognition of the individual elements difficult. The neural arches of adjacent vertebrae are completely fused. The specimen of *M. fossilis* from Florida (FGS V-5691) shows less complete fusion of the neural arches, in that foramina, which represent unfused portions of the neural arches, are present. These are represented in the Friesenhahn specimen by depressions. The fusion in *Tayassu* is not as far advanced as in *Mylohyus*.

The anterior segment, which is the only one which articulates with the ilium, has a greatly flattened centrum and large, rounded prezygapophyses set close to the sacro-iliac junc-

tion. Behind each prezygapophysis is a round depression. At the posterior margin of each depression is a foramen which marks the division between the first and second sacral vertebra. The neural arch is low as in other known tayassuids.

The number of caudal vertebrae is unknown in *Mylohyus,* but the known segments indicate a tail proportionately as long as in the living peccaries. The transverse processes on the anterior caudals are much reduced as in *Platygonus.* In *Tayassu* these processes take the form of spine-like projections.

Ribs

There are fourteen ribs. The first two are short, heavy, and straight. Posteriorly the ribs take on the usual curved shape and become thin and flattened. At the level of the seventh rib a flat surface develops on the dorsal surface near the head which gives an angled appearance to the proximal part of the rib. It disappears in the last two ribs. This surface is present in *Tayassu* but is less prominent.

Sternum

Seven sternal segments are present in *Mylohyus* in contrast to six in *Tayassu.* The presternum is not as slender as in *Tayassu* and the anterior end is much more expanded. The processes for the attachment of the first pair of sternal ribs are joined rather than separate as in *Tayassu.*

The second segment is much like that of *Tayassu* which is deep anteriorly and flattened posteriorly.

The next four segments are flattened and square and increase in size posteriorly with number six the largest.

The xiphisternum is small and flattened, and tapers posteriorly. The posterior end is unfinished, indicating the existence of a posterior cartilaginous process.

Fore Limb

Scapula.—The scapula of *Mylohyus* is the normal tayassuid type. Very little difference can be found between the scapulae of the known genera which is not attributable to a size difference. The glenoid fossa is more oval in *Mylohyus* than in *Tayassu.* The difference is in the outer margin which is slightly straightened in *Mylohyus.*

Humerus.—The humerus of *Mylohyus* is similar in over-all shape and proportions to that of *Tayassu.* It is much more slender than the humerus of *Platygonus.* It also differs from that of the latter genus in the arrangement and shape of some of the processes. The greater tuberosity at the proximal end is triangular in side view in *Mylohyus* and rounded in *Platygonus.* The pectoral process projects more in *Mylohyus* and is not joined to the deltoid process by a strong ridge.

At the distal end of the humerus the ridge on the lateral edge of the anconeal fossa is located farther out from the fossa, and more on the lateral surface of the humerus in *Mylohyus.* This resembles the situation in *Tayassu* rather than in *Platygonus* where the ridge is located on the posterior portion of the humerus.

The medial border of the anconeal fossa is narrower and more angular in *Mylohyus* than in *Platygonus.* This again is similar to *Tayassu.*

These features of the humerus are present in all specimens examined and seem to represent constant differences from *Platygonus.*

Radius and ulna.—The radius and ulna of

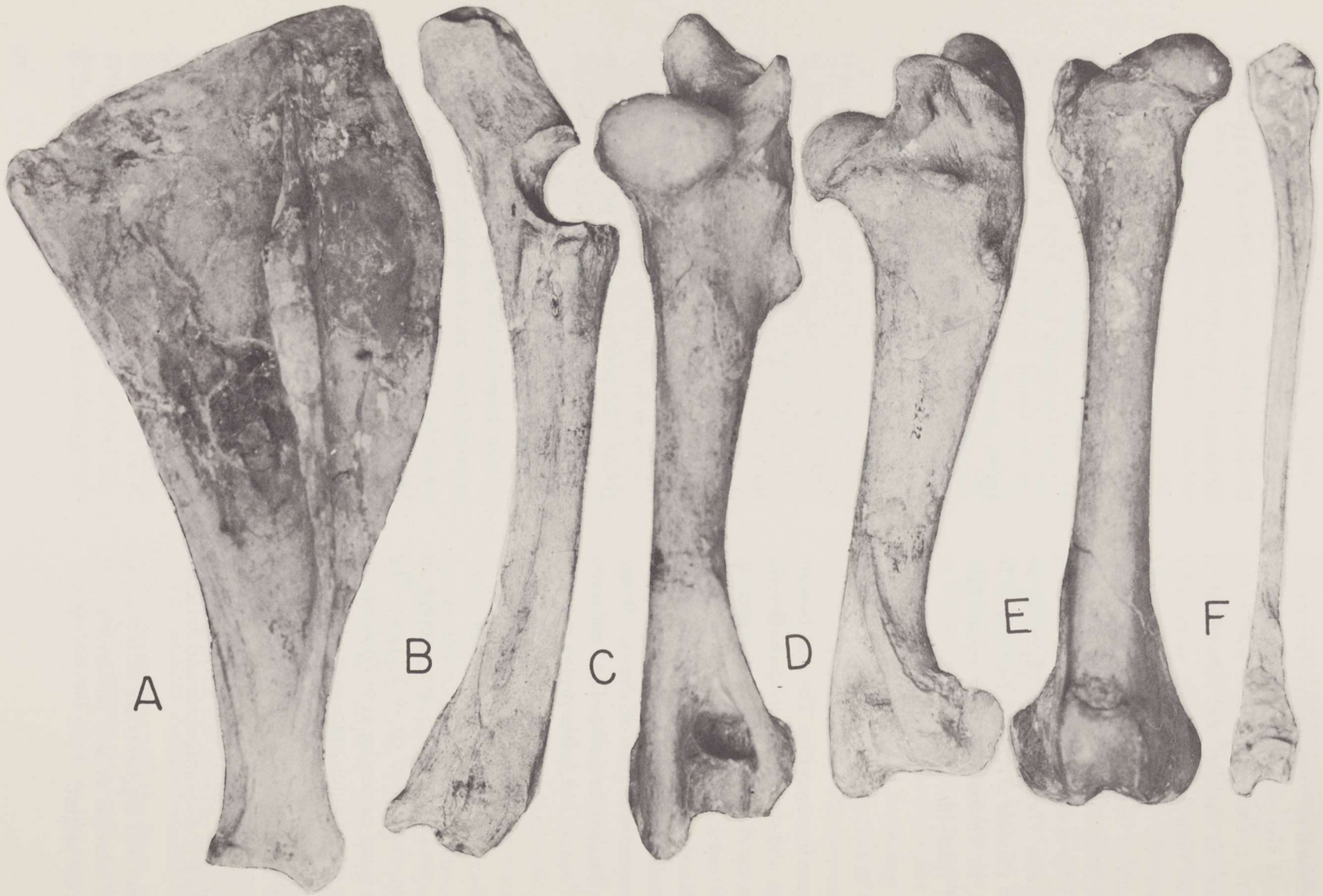

PLATE IV

A. Lateral view of right scapula; B. Lateral view of right radius-ulna; C. Posterior view of right humerus; D. Lateral view of right humerus; E. Anterior view of right femur; F. Lateral view of right fibula, x.6.

PLATE IV

G. Lateral view of right pelvis; H. Medial view of right pelvis; I. Anterior view of right astragalus; J. Medial view of right calcaneum; K. Anterior view of metacarpals III and IV; L. Anterior view of right tibia; M. Anterior view of posterior cannon bone, x.6.

Mylohyus are fused as in other tayassuids. It is more slender and more lightly constructed than that of *Platygonus*. It differs from the radius-ulna of *Tayassu* in that there is less antero-posterior curvature. This curvature is evenly distributed throughout the length, while in *Tayassu* the bone is relatively straight proximally and bends rapidly near the distal end.

Manus.—The carpus which has been described by Brown (1908) shows no differences in the arrangement of characters of the elements from either *Platygonus* or *Tayassu* except for size and robustness.

Metacarpals III and IV are slender and unfused as in *Tayassu*. They are much more slender than those of either *Platygonus* or *Tayassu*.

Metacarpals I and V are present but reduced. They extend distally to about the same positions on III and IV as in *Tayassu*. Metacarpal II is shorter and more robust than V. They articulate with III and IV by small facets located posteriorly on the proximal ends. There is no articulation with the carpus. The lateral metacarpals of the Florida specimen are more slender than in the Friesenhahn specimen. The lateral metacarpals of *Platygonus* consist of a very short splint for II and a nodule of bone for V.

The unguals are laterally flattened rather than dorsally as in *Platygonus*.

Pelvic Girdle

The pelvis of *Mylohyus* is almost identical to that of *Tayassu* except for size and prominence of the muscle scars.

Hind Limb

Femur.—The femur of *Mylohyus* differs from that of *Platygonus* in being more slender and in having less prominent processes. The first trochanter is thicker than in *Platygonus* and less turned in toward the ball than in either *Platygonus* or *Tayassu*. In the two latter genera the edge of the digital fossa and the outer surface of the first trochanter turn inward toward the ball of the femur. This results in a curved border of the digital fossa on *Platygonus* and *Tayassu* while *Mylohyus* has a straight one.

Tibia.—The tibia is slender, bowed slightly outward, and has approximately the same proportions as that of *Tayassu*. The tibia is heavier and thicker in *Platygonus*. The cnemial crest is prominent, with a hollow formed on the lateral side. This crest extends farther down the tibia in *Platygonus* than in *Mylohyus*. The crest is 46% of the length of the tibia in *Platygonus*, 34% in *Mylohyus*, and 38% in *Tayassu*.

On the proximal part of the posterior surface are three sharply defined ridges. The middle one begins at the center of the proximal end, extends downward and outward, and then follows the curvature of the shaft until it dies out about half way down the tibia. The outer ridge begins about one-half inch below the top of the tibia and extends for about an inch parallel to the outer edge of the shaft before dying out. The third ridge arises from the center one about an inch below the top of the tibia and extends downward across the posterior surface and meets the inner edge somewhat above the midpoint of the shaft. From here it extends along this edge to the distal end of the tibia. A prominent process is located on the inner edge of the tibia about one and one-half inches below the top of the bone. These processes are similar to those found on the tibia of *Tayassu* but are better developed.

Fibula.—This bone is very slender, expanded on each end, with a distinct bend in the proximal portion. The proximal expansion is symmetrical, which along with the distinct bend in the proximal part, differentiates this bone from that of *Tayassu* which has an asymmetrical proximal expansion and no such abrupt bend. A ridge extends along the center of the outer surface from the proximal end to the midpoint of the shaft. A groove is present on the inner surface of the bone in *Mylohyus* and *Tayassu*. The larger proximal expansion in *Mylohyus* results in a larger surface of articulation with the tibia than is found in *Tayassu*.

Pes.—The tarsus has been described by Brown (1908) who pointed out that the ento- and meso-cuneiforms are more reduced than in *Platygonus*.

The metatarsals, as pointed out by Brown (1908), are about the same length as in *Platygonus* but are slimmer, resembling those of *Tayassu*. Metatarsal II is present but slender. Metatarsal V is apparently absent as no trace of an articular facet can be found on number IV. It is present in *Platygonus* and *Tayassu* as a small nodule of bone.

Metatarsals III and IV are fused as in *Platygonus* and *Tayassu* but the fused area extends farther toward the distal end than in *Tayassu*. There is less expansion of the ends of these bones than in *Platygonus*.

The Species of *Mylohyus*

THE genus *Mylohyus* was set up by Cope (1889) to contain peccaries with elongated skulls, upper incisors reduced to two above and below. Gidley (1921) added other characters such as molariform P^{3-4}_{3-4}, loss of lateral digits confined to hind feet, and molars characterized by principal, subequal cusps.

Cope (1899) recognized three species: *M. nasutus* Leidy 1869, *M. pennsylvanicus* Leidy 1889, and *M. tetragonus* Cope 1899. Since then five additional species have been described and named. Most of these species are based on one, usually fragmentary specimen.

The following characters have been used by various authors to distinguish the different species of *Mylohyus*: presence or absence of grooves on the canines, degree of development of stylar cusps, relative length of post canine diastema, development of accessory cuspules especially the paraconulid, proportions of the cheek teeth, complexity of P_2, and presence or absence of a shelf extending forward from the infraorbital canal. Previous authors were unable to determine the amount of variation of these characters in each species because of the lack of adequate samples. Three samples are now available which appear to have been drawn from populations of limited time intervals and limited geographic areas and thus seem to be suitable for giving information on population variation. They are from the Conard Fissure in Arkansas, Friesenhahn Cave in Texas, and late Pleistocene deposits near Melbourne, Florida. Only the Florida sample is large enough to justify the use of quantitative methods.

Four teeth (P^3, M^1, M^3, M_1) are present in sufficient numbers to furnish adequate samples of only one side. Histograms of the lengths of these have been prepared for the Florida sample and for all other material (Figure 4). The coefficients of variation of the lengths, anterior widths, and posterior widths have been calculated for the Florida sample, all others, and for the total sample (Table 1).

The values of the coefficients of variation for the Florida sample range from 2.67 to 7.5 which is well within the range to be expected for mammals. In addition, Simpson's (1949) data on variation in a sample of *Platygonus* show a range from 3.72 to 7.15 and Konizeski's (unpublished) data on variation of P^3, M^1, M^3, and M_3 in the two species of recent peccaries show a range from 5.5 to 7.76 for *Tayassu tajacu* and 4.75 to 7.24 for *Tayassu pecari*. Table 1 shows that in every case the value goes up when specimens from other localities are added to the sample. This indicates that the total sample is much more heterogeneous than the Florida sample.

The histograms of the lengths of three teeth (P^3, M^1, M_1) show two modes for the Florida sample (Figure 4). The low values of the coefficient of variation probably indicate that the bimodality is due to sexual dimorphism. If the bimodality were due to two species the values of the coefficient of variation for each species would be improbably low. The other tooth (M^3) shows one mode.

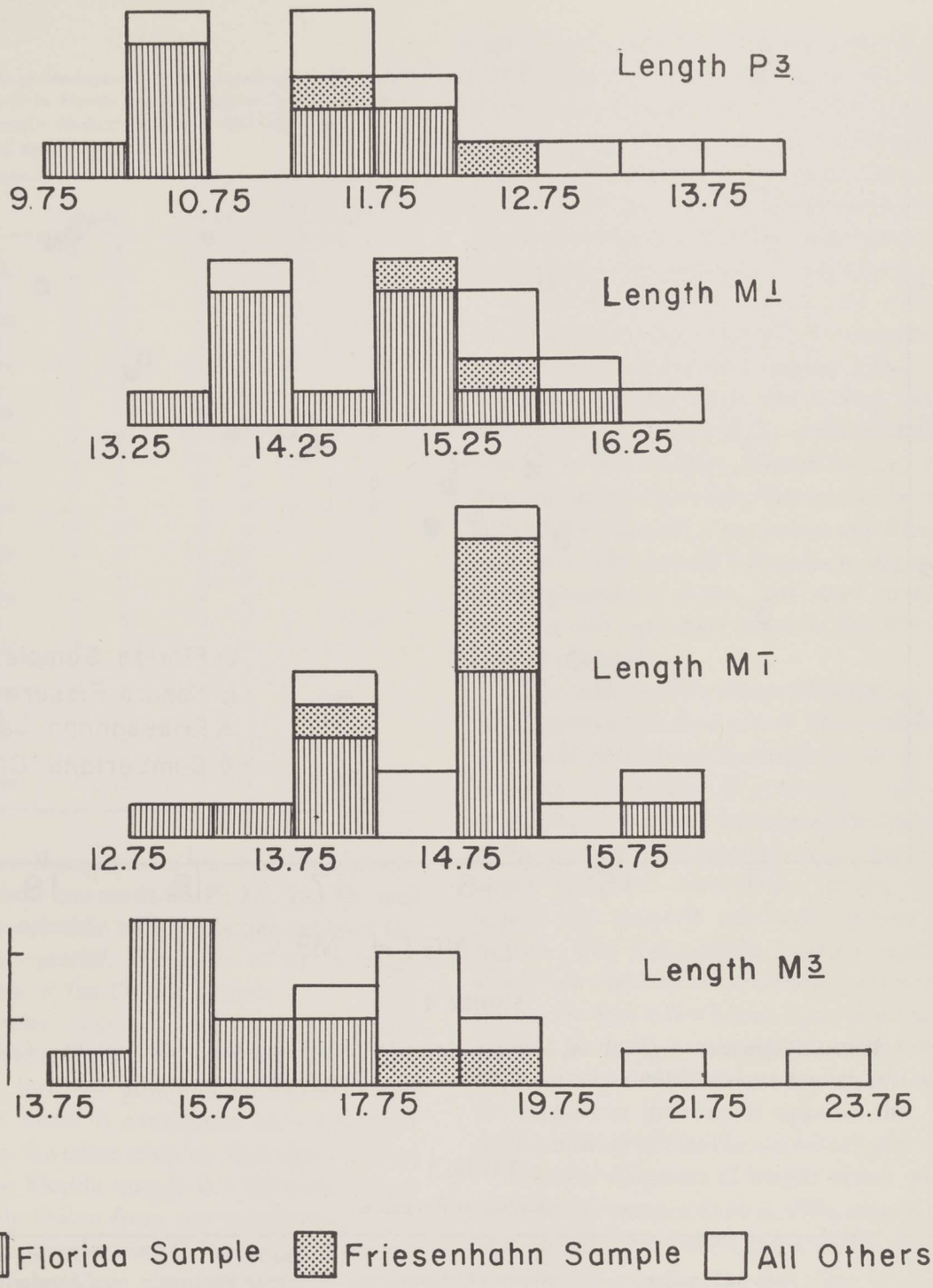

FIGURE 4

Histograms of lengths of P^3, M^1, M_1, and M^3.

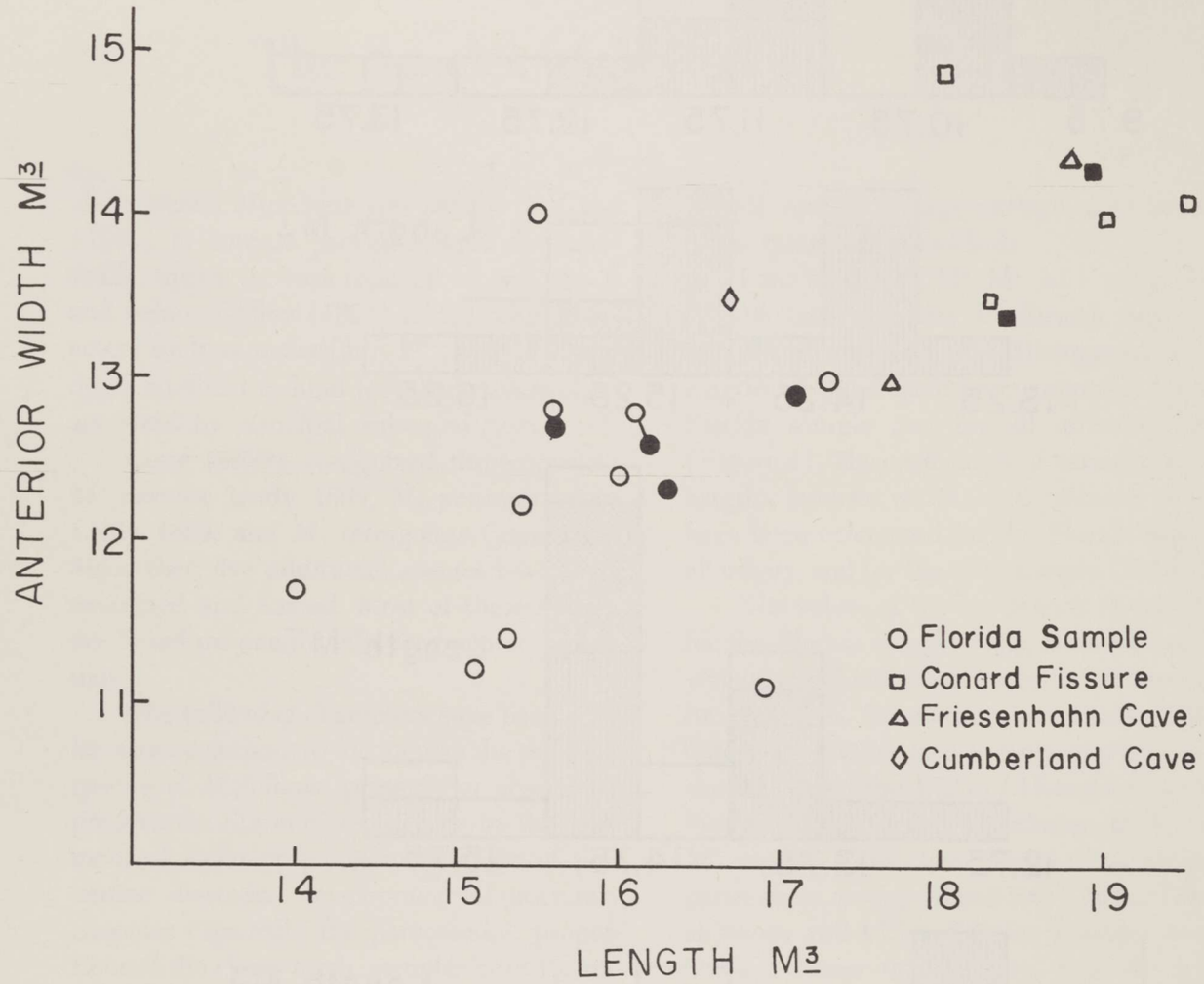

FIGURE 5

Scatter diagram of length M^3 vs. anterior width of M^3. Open symbols indicate right teeth, solid symbols left teeth. Symbols joined by a line indicate one individual.

TABLE 1

Coefficients of Variation

Sample	Left P^3			Right M^1			Left M^3			Left M_1		
	Length	Anterior Width	Posterior Width	Length	Anterior Width	Posterior Width	Length	Anterior Width	Posterior Width	Length	Anterior Width	Posterior Width
Florida	6.38	2.67	5.90	4.95	5.60	4.16	5.95	7.50	5.10	5.30	5.60	5.00
All other	10.00	4.54	.....	5.78	.....	.....	9.65	5.46	.....	5.41	7.48	5.86
Total Samples	14.10	9.03	8.46	5.92	9.37	6.73	13.50	11.15	9.02	7.16	6.01	6.19

TABLE 2

Degree of development of cingula and stylar cusps. Numbers of teeth in Florida Sample (Roman face) and Conard Fissure Sample (italics) with large and small cingula and presence of stylar cusps.

		Small		Large		Parastyle Metastyle	
P^2	Left	0	*0*	2	*2*	..	..
	Right	2	*0*	1	*1*	..	..
P^3	Left	2	*1*	5	*0*	..	..
	Right	1	*0*	6	*1*	1	*0*
P^4	Left	1	*1*	1	*3*	0	*1*
	Right	1	*0*	5	*2*	2	*1*
M^1	Left	0	*2*	0	*2*	..	..
	Right	2	*1*	9	*2*	3	*0*
M^2	Left	1	*0*	2	*3*	1	*0*
	Right	0	*1*	5	*2*	..	..
M^3	Left	2	*1*	7	*3*	1	*0*
	Right	1	*0*	3	*3*	1	*0*
P_2	Left	0	*0*	3	*0*	..	..
	Right	0	*0*	1	*0*	..	..
P_3	Left	1	*0*	3	*0*	..	..
	Right	6	*2*	0	*0*	..	..
P_4	Left	3	*3*	3	*0*	1	*0*
	Right	4	*1*	1	*1*	..	..
M_1	Left	5	*1*	3	*0*	..	..
	Right	6	*1*	4	*1*	..	..
M_2	Left	2	*1*	1	*1*	..	..
	Right	4	*1*	2	*1*	..	..
M_3	Left	5	*4*	2	*0*	..	..
	Right	5	*2*	1	*1*	..	..

The histograms of the non-Florida material show one mode for P^3, M^1, and M_1, and tend to coincide with the larger mode of the Florida material. The mode of M^3 is larger than that of the Florida sample.

Scatter diagrams of length against anterior width show that in general, the Florida sample forms a group of small-sized individuals which is overlapped to varying degrees by the other samples. This also indicates that the Florida sample is a coherent group, probably drawn from one population.

The samples from the Conard Fissure and Friesenhahn Cave also appear to be drawn from one population each. Although these samples are too small to justify the use of a quantitative estimate of variability, the scatter diagrams of length versus anterior width and length versus posterior width of M^3 show about the same degree of homogeneity as the Florida sample (Figure 5). The Cumberland Cave sample contains individuals which fall into both size groups. The sample is too small to show whether this indicates the presence of two species or an intermediate population.

Only the Conard Fissure and Florida samples contain enough teeth to warrant an analysis of the variation of cingular and accessory cusps (Tables 2,3,4). No striking difference in the complexity of the teeth is seen between the two samples. Several Conard Fissure specimens show crenulations on the cingula which were not observed on any Florida specimens. The over-all difference in size gives the impression of larger and more complex cingular and accessory cusps in the Conard Fissure material.

The canines of the Conard Fissure sample are all grooved to some extent. The number of canines from the Florida sample on which the presence or absence of grooving could be established is very low because of the removal of the enamel by weathering. Only four (two upper and two lower) are usable. Both uppers are grooved and both lowers are smooth. The Friesenhahn sample contains specimens which show prominent grooves and specimens with a few broad, open grooves. In general, the badly worn teeth show the broad, open grooves and the relatively unworn ones, the numerous grooves. It appears that the degree of wear affects the amount of grooving.

Scatter diagrams of length versus width of the upper canines show no difference in size or proportions between the Conard Fissure and Florida samples. On the other hand the scatter diagrams of length versus width of the lower canines show the Conard Fissure and Friesenhahn specimens to be larger than the

TABLE 3

Size of paraconulid in Florida sample (Roman face) and Conard Fissure Sample (Italics).

	No. P_2	No. P_3	No. P_4	No. M_1	No. M_2	No. M_3
Large Paraconulid						
Left	1 *1*	6 *2*	8 *2*	3 *7*	5 *3*	
Right	5 *2*	5 *2*	10 *2*	6 *0*	3 *0*	
Small Paraconulid						
Left	0 *1*	0 *2*	.. ..	.. ..	1 *1*	
Right	.. ..	.. ..	1 *0*	0 *2*	3 *3*	

TABLE 4

Development of posterior cingular cusps on M^3

	No. Posterior Cingular Cuspules	No. of M^3's Left	No. of M^3's Right	No. of M_3's Left	No. of M_3's Right
Florida Sample	1	0	1	1	1
	2	5	0	4	1
	3	1	0	0	2
	4	1	1	1	2
	5	0	0	1	1
Conard Fissure Sample	1	0	0	0	0
	2	0	0	1	0
	3	0	0	1	3
	4	0	0	1	0
	5	0	1	1	0

Florida specimens, with some overlap of the two size groups (Figure 6).

The number of cusps on P_2 and on the heel of M^3 has been used to differentiate species of *Mylohyus*. Table 5 shows the variation in the complexity of these teeth. Although the samples are small they indicate no difference between the Florida and Conard Fissure samples which would be reliable in separating species. Because of the size difference of M^3 between the two samples, a large sample might show a difference in the number of posterior cuspules related to the difference in size.

There is no difference in complexity of

TABLE 5

Number of anterior and posterior cusps on each P_2 from Florida and Conard Fissure

	Left P_2 No. Anterior Cusps	Left P_2 No. Posterior Cusps	Right P_2 No. Anterior Cusps	Right P_2 No. Posterior Cusps
Conard Fissure Sample	1	5	2	4
	2	3	2	4
	2	4	..	..
	?	3	..	..
	2	5	..	..
Florida Sample	..	..	1	3
	..	..	2	3
	..	..	2	4

P_2 between the Florida and Conard Fissure samples. The Friesenhahn sample shows no variation in the number of cusps. All have four main cusps, two anterior and two posterior.

The relative lengths of the premolar and molar series, the post canine diastema, and the width across the jaws have been used to distinguish species. Scatter diagrams of pairs of these characters show differences between the Florida and Conard Fissure samples in two characters: length of lower cheek teeth versus length of lower post canine diastema, and length of lower molars versus length of lower post canine diastema. It is obvious that the variation in the relative lengths of the lower cheek teeth and the lower post canine diastema is due to a difference in the length of the lower molars. The Conard Fissure sample has a longer lower-molar series than the Florida sample (Figure 7).

Although the samples from Florida, Conard Fissure, and Friesenhahn Cave are small, it appears that they represent two populations, here designated A and B. One, population A, represented by the Conard Fissure and Friesenhahn Cave samples, is characterized by large size, with large, robust M^3_3, a long molar series with respect to the post canine diastema,

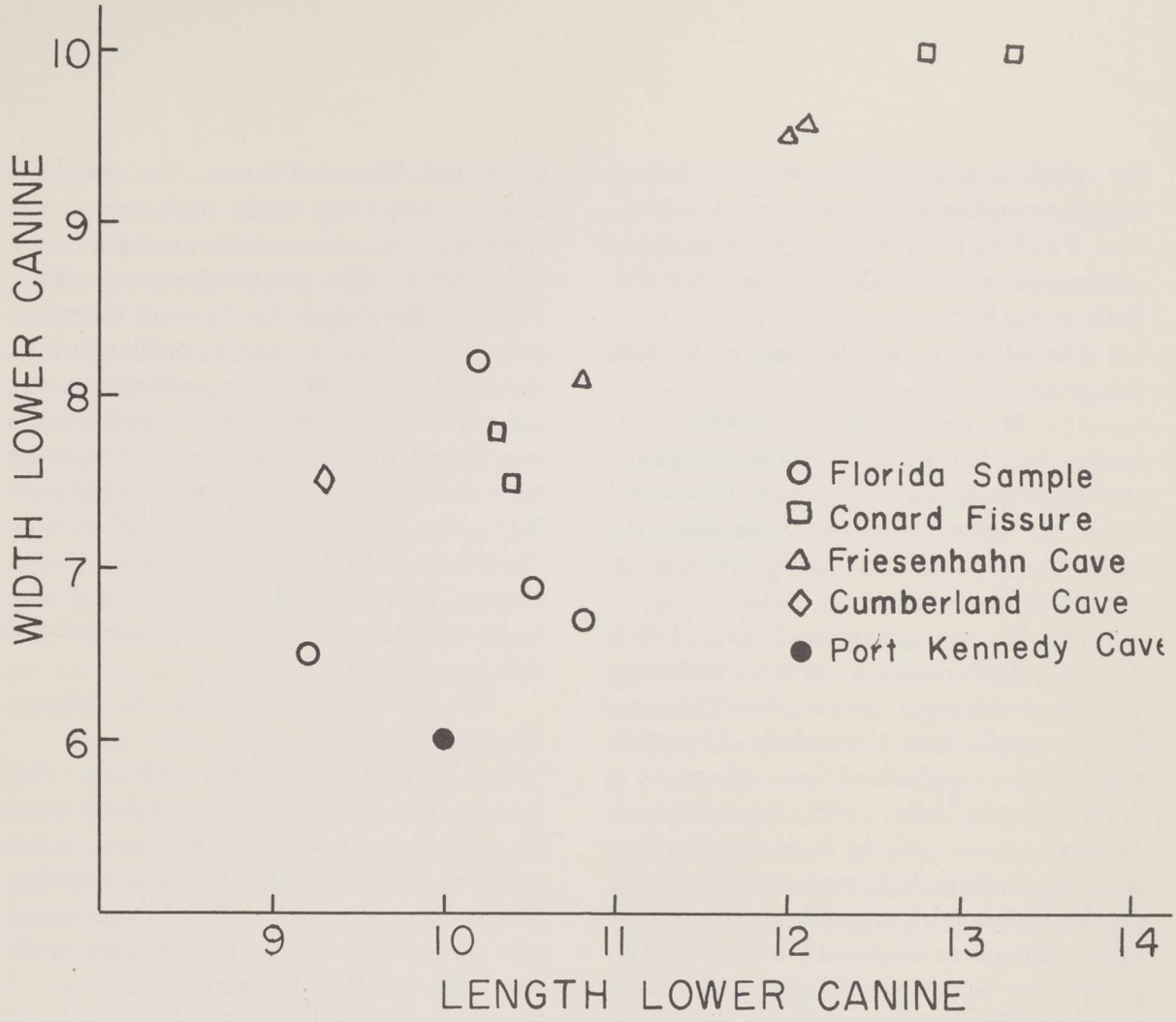

FIGURE 6

Scatter diagram of length vs. width of lower canine.

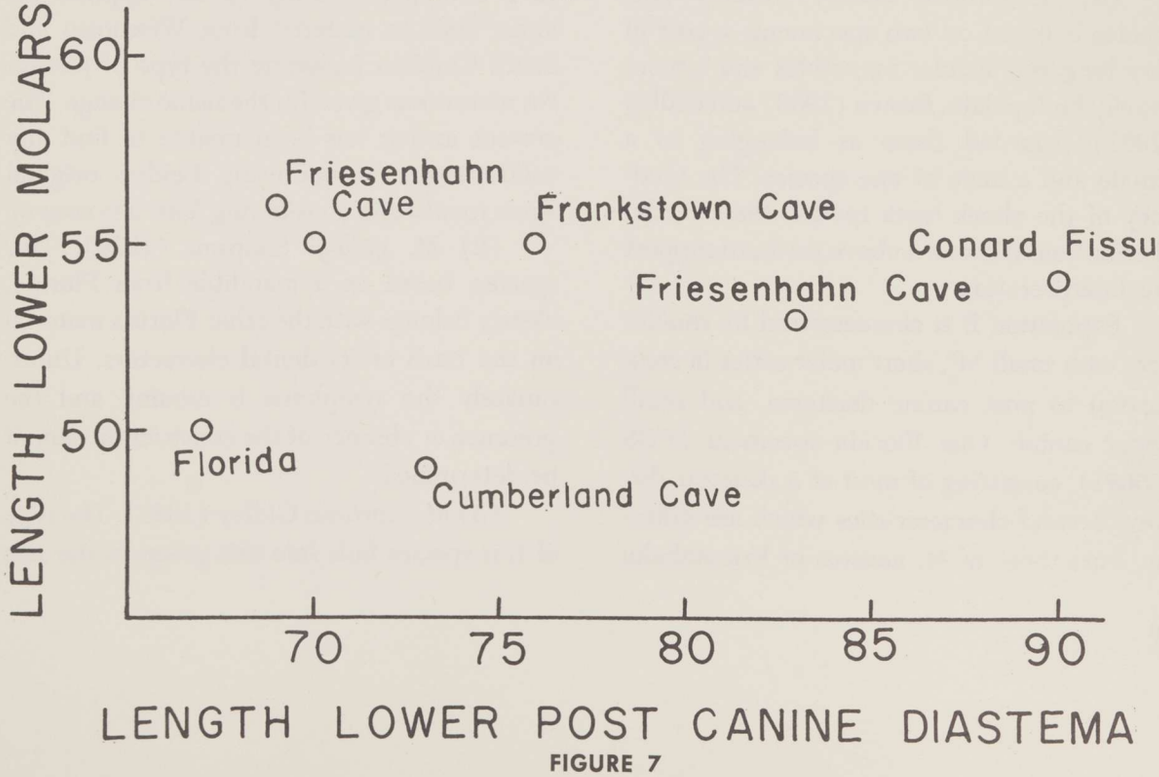

FIGURE 7

Scatter diagram of length of lower molars vs. length of post canine diastema.

dP^3 which is relatively slender and lacks a cingular cusp between the paracone and metacone, I^1 reduced to a simple peg, a large upper canine, and relatively heavy third and fifth digits on the feet.

The following described species fall into this group:

(1) *M. nasutus* Leidy (1869). This species, based on a rostral fragment, is placed in this group on the basis of over-all size and the size of the upper canine. Since this is the earliest name given to any species in this group it is the valid name for the species.

(2) *M. pennsylvanicus* Leidy (1889). The type of this species is a juvenile individual with the deciduous dentition. The dP^3 is more like a juvenile from Friesenhahn Cave than one from the Cumberland Cave referred to as *M. exortivus* by Gidley (1921). Since the number of specimens with the deciduous dentition is totally inadequate to give any information on the variation of the milk teeth, the very minor differences observed between the two groups may be entirely owing to accidents of sampling. The assignment of the type of *M. pennsylvanicus* to this species is tentative.

(3) *M. browni* Gidley (1921). This species is based on two specimens: a pair of very long and slender mandibles and a more heavily built palate. Brown (1908) and Gidley (1921) regarded these as belonging to a female and a male of one species. The tendency of the cheek teeth toward the bimodal distributions discussed above seems to support this interpretation.

Population B is characterized by smaller size, with small M_3^3, short molar series in comparison to post canine diastema, and small upper canine. One Florida specimen (FGS V-5691), consisting of most of a skeleton, displays several characteristics which are different from those of *M. nasutus* of Friesenhahn Cave and Conard Fissure. The mandible shows a narrowing of the underside of the symphysis just anterior to the mental foramen (Figure 8,A). This constriction is not noticeable from the dorsal side. None of the specimens referred to *M. nasutus* on the basis of dental characters and proportions has any trace of this constriction. On the contrary, the symphyseal region has a smooth, even curve from the region of P_2 to the canines (Figure 8, B-D). This Florida specimen also differs from the Friesenhahn Cave and Conard Fissure material in having a larger I^1 which is oval in cross section, and more slender second and fifth metapodials.

The following described species fall into population B:

(1) *M. fossilis* Leidy (1860a). This species, based on one M_3 from the Ashly River deposits of South Carolina, is placed in this group on the basis of its size and proportions. Because it is among the smaller specimens of this group, it was placed in a separate small-sized species. It is the earliest specimen of *Mylohyus* recorded from North America and is the valid name for the small-sized species. In a later paper Leidy (1869) applied the name *lenis* to material from Wisconsin and South Carolina including the type of *fossilis*. No reason was given for the name change. The present author has been unable to find any valid reason for not using Leidy's original name *fossilis* and considering *lenis* a synonym.

(2) *M. gidleyi* Simpson (1929). This species, based on a mandible from Florida, clearly belongs with the other Florida material on the basis of its dental characters. Unfortunately the symphysis is missing and the presence or absence of the constriction cannot be determined.

(3) *M. exortivus* Gidley (1921). The type of this species falls into this group in the size

and shape of most of the teeth and in the proportion of the molar series and the post canine diastema. The size is that of the larger Florida specimens. The deciduous teeth associated with the type are slightly smaller than those from Friesenhahn Cave, as mentioned above. Unfortunately no dP^3 is known from Florida and a comparison of this character cannot be made. Minor differences between the Cumberland Cave material and the Florida material may be interpreted as a slight age difference or a geographic difference. Hibbard (1958) gives the age of the Cumberland Cave fauna as late Sangamon—early Wisconsin; the age of the Florida material is almost certainly late Wisconsin.

Three other species of *Mylohyus* have been described: *M. tetragonus* Cope (1899) from the Port Kennedy Bone Deposit; *M. temerarius* Hay (1914) from Sioux City, Iowa; and *M. obtusidens* Hay (1920) from Cavetown, western Maryland. The latter two species are based on isolated canines and are not specifically (and probably not generically) identifiable.

M. tetragonus resembles *M. nasutus* in the size of M_3 and the lower molars and the lower post canine diastema. It is unique in the absence of a paraconulid and in the tetragonal cross section of the lower canines. The former character might reasonably be expected to appear in a larger sample of the Conard Fissure population as some of the specimens showed very poorly developed paraconulids. Nothing approaching the tetragonal cross section of the lower canines is found in any other specimen. Until the possibility that this is an abnormal character, as suggested by Gidley (1921), can be verified by additional material, it seems that the morphological differences indicate a distinct species. There is in addition an age difference between *M. tetragonus*, which appears to be Yarmouthian in age (Hibbard 1958), and the others, which are younger.

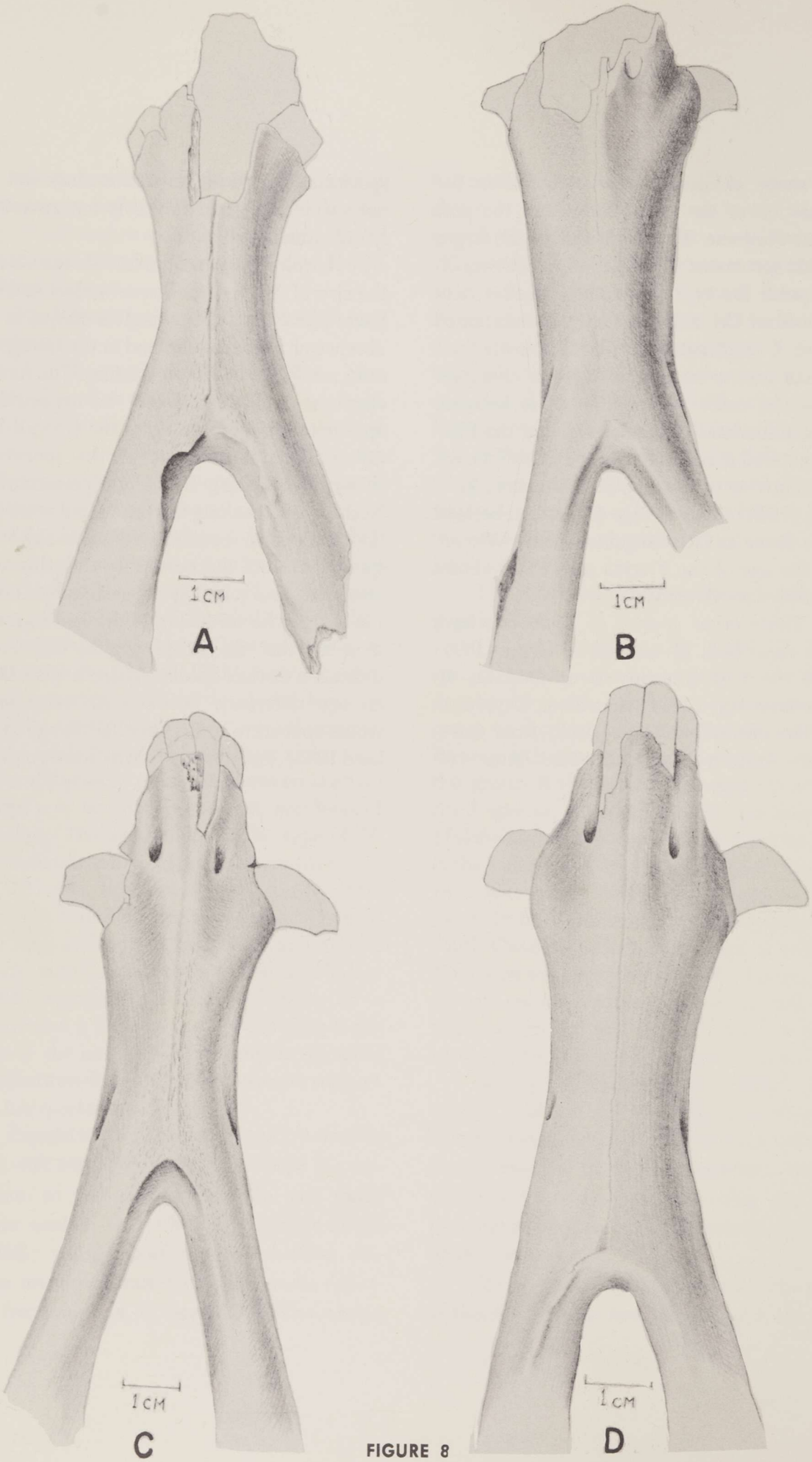

FIGURE 8

Ventral side of mandibular symphysis of: A, *Mylohyus fossilis* from Florida (FGS 5691); B, C, D (TMM 933–995, –1350, –3232 respectively), *Mylohyus nasutus* from Friesenhahn Cave, Texas, showing the difference in the symphyseal constriction.

Relationships

THE genus *Mylohyus* almost certainly was derived from the Pliocene genus *Prosthennops* although it is impossible to single out any particular species as ancestral, if indeed any one species is the ancestor of the genus *Mylohyus*. Colbert (1938) lists several species of *Prosthennops* which approach the *Mylohyus* condition in the loss of I^3 and molarization of the premolars. This indicates the possibility that *Mylohyus* is polyphyletic.

Known specimens of *Mylohyus* differ from known specimens of *Prosthennops* in larger size, more elongated skulls with resulting longer post canine diastema, I^{1-2} reduced to pegs equal or nearly equal in size, more complete molarization of premolars, and fusion of metatarsals III and IV.

Distribution and Ecology

With two exceptions all of the specimens of *Mylohyus* reported to date are from the eastern or central portions of North America. Merriam (1915) reported a specimen from the Etchigoin formation of California, but Colbert (1938) referred it to *Prosthennops*. Hay (1921) reported the presence of *Mylohyus* in Pleistocene deposits from Coconino County, Arizona. This is based on a fragmentary radius which could easily belong to a small *Platygonus*. In addition, *Mylohyus* has been reported from the following states: Pennsylvania (Leidy, 1889; Cope, 1899; Peterson, 1926), Maryland (Gidley, 1921), Ohio (Hay, 1914), Indiana (Leidy, 1860b), Iowa (Hay, 1914), Wisconsin (Hay, 1918), Missouri (Olson, 1940), Tennessee (Hay, 1920), South Carolina (Leidy, 1860a; Allen, 1926), Arkansas (Brown, 1908), Florida (Simpson, 1928, 1929, 1930; Gazin, 1950; Bader, 1957), and in this paper, Texas.

The distribution of the two late Pleistocene species is interesting. The data indicate that *M. fossilis* is an east coast form ranging from Florida to Maryland. *M. nasutus* appears to be more western in its distribution. The only place where overlap is indicated with any certainty is in the Cumberland Cave deposit in Maryland where teeth occur which fall into both size groups.

Whenever a fauna can be associated with *Mylohyus* a forest situation is indicated. Such characteristic forest forms as beaver (*Castor*, sp.), giant beaver (*Castoroides*, sp.), tapir (*Tapirus*, sp.), jumping mouse (*Zapus*, sp.), and flying squirrel (*Glaucomys*, sp.) have been found associated with *Mylohyus*.

The association with tapir, mastodon, and an extinct species of *Testudo* (*Testudo wilsoni* Milstead) in Friesenhahn Cave indicates forested areas in the vicinity and probably wetter conditions than at present. There are a number of species, such as the horse, coyote, bison, camel, and jack rabbit, which are usually more characteristic of open country. Friesenhahn Cave is located on the edge of the Edwards Plateau which is semi-arid today. The canyons along the edge of the Edwards Plateau today are more humid than the divides. A similar situation probably existed during the late Pleistocene. This would explain the presence of both forest and grassland types in the Friesenhahn Cave deposits. In view of the geographical distribution of *Mylohyus* it seems most likely that it was an inhabitant of the better-watered parts of the area. This distribution and faunal association, along with its long rostrum and strongly bunodont teeth, indicate that it was a close ecological equivalent of the European *Sus*.

TABLE 6

Measurements of Mylohyus nasutus *from Friesenhahn Cave*[1]

Cranial Measurements:		TMM 933–3232 Left	TMM 933–3232 Right	TMM 933–1350 Left	TMM 933–1350 Right	TMM 933–995 Left	TMM 933–995 Right	TMM 933–3360 Left
Post canine diastema		83.1	87.8	70.0	69.4	79.4	76.4	.....
Pre canine diastema		11.3	11.5	9.7	8.9	.....	.....	.....
Depth of jaw at M_1		39.3	40.1	34.6	35.4	.....	.....	.....
Thickness of jaw at M_1		17.6	17.6	20.1	19.9	.....	.....	18.6
Width across both jaws at M_1		65.5	.....	67.6	.....	.....	.....	.....
Width of jaws at canine		34.0	.....	32.0	.....	33.3	.....	.....
Width between canine alveoli		17.1	.....	14.6	.....	17.3	.....	.....
Canine	L	12.0	12.2	12.1	12.0	10.8	10.4	.....
	W	9.5	9.3	9.6	9.3	8.1	8.2	.....
P_2	L	9.8	9.4	10.6	10.1	.....	10.8	.....
	AW	5.2	.....	5.6	5.2	.....	5.5	.....
	PW	6.1	.....	6.8	6.5	.....	7.3	.....
P_3	L	11.3	12.0	12.8	12.8	.....	.....	.....
	AW	8.9	.....	9.4	9.5	.....	10.3	.....
	PW	9.8	.....	10.7	10.7	.....	10.8	.....
P_4	L	11.9	.....	13.9	14.2	.....	14.7	.....
	AW	11.5	.....	12.5	12.3	.....	12.8	.....
	PW	12.2	.....	13.2	13.3	.....	12.6	.....
M_1	L	14.9	15.1	15.2	15.1	.....	14.2	15.1
	AW	12.5	.....	13.7	13.6	.....	12.8	12.9
	PW	12.4	.....	14.0	14.0	.....	12.3	12.9
M_2	L	16.9	16.7	17.2	16.8	.....	.....	15.9
	AW	14.2	.....	14.5	14.8	.....	.....	14.1
	PW	13.3	.....	14.4	14.5	.....	.....	13.1
M_3	L	21.7	23.7	22.8	23.7	.....	.....	19.3
	AW	13.1	.....	14.1	13.9	.....	.....	12.5
	PW	11.7	.....	12.2	12.6	.....	.....	11.4
Length molar-premolar series		87.0	79.4	92.0	92.2	.....	.....	.....
Width symphysis at narrowest point		22.1	.....	23.2	.....	23.9	.....	.....
Total length jaw cond. to ant. end symph.		270.0	268.0	247.0	247.0	.....	.....	.....
Width across cond.		112.0	.....	105.0	.....	.....	.....	.....
Length premolars		33.0	.....	37.3	37.1	.....	.....	.....
Length molars		53.5	55.5	55.2	55.6	.....	.....	50.3
Width across P_2		39.0	.....	41.5	.....	47.5 (Approx.)	.....	.....

Cranial Measurements:		TMM 933–3232 Left	TMM 933–3232 Right	TMM 933–3581 Left	TMM 933–1401 Right	TMM 933–1402 Right
Canine	L	13.1	13.5	.....	.....	.....
	W	10.1	9.2	.....	.....	.....
P2	L	9.6	9.5	.....	.....	.....
	AW	8.1	8.0	.....	.....	.....
	PW	8.7	8.7	.....	.....	.....
P3	L	12.5	11.3	.....	.....	.....
	AW	11.5	10.0	.....	.....	.....
	PW	12.3	10.7	.....	.....	.....
P4	L	14.2	13.5	.....	.....	.....
	AW	13.9	11.7	.....	.....	.....
	PW	14.3	13.0	.....	.....	.....
M1	L	15.7	14.9	.....	15.7	.....
	AW	14.7	13.6	.....	14.8	.....
	PW	15.1	13.7	.....	15.1	.....
M2	L	17.1	16.2	.....	.....	17.3
	AW	16.1	14.1	.....	.....	16.0
	PW	15.5	14.2	.....	.....	15.2
M3	L	18.8	17.7	18.8	.....	.....

		TMM 933–1407 Left	TMM 933–1407 Right
dP_2	L	.....	7.6
	AW	.....	4.3
	PW	.....	5.0
dP_3	L	.....	11.3
	AW	.....	6.4
	CW	.....	6.9
	PW	.....	7.4
dP_4	L	17.1	17.3
	AW	9.8	9.8
	CW	9.0	9.0
	PW	10.3	.....
M	L	.....	14.8
	AW	.....	12.1
	PW	.....	12.8

		933–3011 Left
dP3	L	12.8

TABLE 6—Continued

Measurements of Mylohyus nasutus *from Friesenhahn Cave*[1]

	AW	14.4	13.0	14.4	.....	.....		AW	9.2
	PW	11.7	10.1	11.7	.....	.....		PW	11.0
Total length, premolars		33.7	34.3				dP4	L	13.1
Total length, molars		48.0	48.8					AW	12.6
Total length, toothrow		82.7	83.1					PW	12.3
Length of diastema posterior to canine		71.0	68.5						
Length of diastema anterior to canine		30.1	25.0						
Width between canine alveoli			30.3						
Total length, condyle to premaxilla			357						
Width across glenoid fossa			115						

[1] All measurements are in millimeters. The following abbreviations have been used: L, Length; AW, anterior width; CW, central width; PW, posterior width.

Postcranial Measurements:	TMM 933–3232 Right	Left
Scapula length	236	230
Humerus, total length	219	216
Humerus, articular to articular	186	183
Radius, Ulna		
Total length of ulna	244	247
Total length of radius	182	182
Metacarpal II		
Length	71.5	.....
Proximal width	3.4	.....
Distal width	7.6	.....
Metacarpal III		
Length	100.8	101.1
Proximal width	19.2	18.6
Distal width	15.8	15.6
Metacarpal IV		
Length	102.7	102.7
Proximal width	16.4	16.1
Distal width	16.1	15.0
Metacarpal V		
Length	78.8	.....
Proximal width	3.8	.....
Distal width	9.4	.....
Proximal width metacarpals III and IV	31.1	31.0
Distal width metacarpals III and IV	33.1	31.5
Astragalus length	42.8	43.0
Proximal width	22.3	21.9
Distal width	22.3	22.8
Femur length	212	220
Proximal width	53.0	53.8
Distal width	52.8	50.1
Tibia length	228	232
Proximal width	53.5	53.5
Distal width	33.0	31.8
Metatarsal II		
Length	55.6	.....
Proximal width	4.4	.....
Distal width	5.5	.....
Metatarsal III		
Length	113.2	114.0
Proximal width	15.4	15.0
Distal width	16.4	16.0
Metatarsal IV		
Length	115.0	114.8
Proximal width	12.4	12.1
Distal width	15.7	15.5
Proximal width metatarsals III and IV	27.0	27.1
Distal width metatarsals III and IV	32.7	33.3
Fibula length	215.0	217.0
Proximal width (anterior-posterior)	19.5	20.5
Distal width (anterior-posterior)	18.5	18.3

	TMM 933–1357
Left ilium—anterior end to acetabulum	119.0
Left ischium—posterior end to acetabulum	113.2
anterior-posterior diameter acetabulum	30.2
Total length pelvis	240.0

TMM Number	Humerus total length	Length between articular surfaces
933–983 Left	.....	191
933–1352 Right	210	182
933–1351 Right	225	191
	Ulna	Radius
933–984 Left	.....	185
933–1356 Right	234	174
933–1355 Left	232	174

	Femur length	Femur prox. width	Femur dist. width
933–1850 Left	194	56	47
933–1353 Left	211	52	47
933–1354 Right	.....	....	47

Appendix

A Preliminary List of the Friesenhahn Cave Fauna

The vertebrate remains recovered from Friesenhahn Cave in Bexar County constitute one of the largest Pleistocene collections from Texas. The great number of species and the relatively large samples of some species give a good picture of the fauna, and make possible statistical comparison with living material. It is the only well-represented Pleistocene fauna known from the Edwards Plateau, which makes it especially important in paleoecological and paleoclimatic studies.

The importance of the fauna as a well-represented one from the southern United States makes it desirable, pending a more detailed study of the material, to publish a preliminary faunal list and to call attention to scattered papers already published.

The following groups have been studied in detail.

Lagomorpha: David Pettus, 1956, "Fossil Rabbits (Lagomorpha) of the Friesenhahn Cave Deposit, Texas." *The Southwestern Naturalist,* Vol. 1: 109–115.

Anura and Squamata: John S. Mecham, 1958 (printed 1959), "Some Pleistocene Amphibians and Reptiles from Friesenhahn Cave, Texas." *The Southwestern Naturalist,* Vol. 1: 17–27.

Peromyscus: James R. Tamsitt, 1957, "*Peromyscus* from the late Pleistocene of Texas." *The Texas Journal of Science,* Vol. 9: 355–363.

Perognathus: Thomas E. L. Kennerly, 1956, "Comparisons between Fossil and Recent Species of the Genus *Perognathus.*" *The Texas Journal of Science,* Vol. 8: 74–86.

Chelonia: W. W. Milstead, 1956, "Fossil Turtles of Friesenhahn Cave, Texas, with the description of a new species of *Testudo.*" *Copeia,* No. 3: 162–171.

The list which follows is incomplete since none of the avian material has been studied. It is based on the published papers listed above and on identifications made by the present author.

CLASS AMPHIBIA

Bufo woodhousei bexarensis Mecham
Bufo cognatus Say
Scaphiopus sp.
Eleutherodactylus augusti Dugés
Rana pipiens Schreber
Rana sp.

CLASS REPTILIA

Order Chelonia

Terrapene canaliculata Hay
Testudo wilsoni Milstead

Order Squamata

Crotaphytus collaris Say
Pituophis melanoleucus Daudin
Crotalus atrox Baird and Girard

CLASS MAMMALIA

Order Marsupialia

Didelphis virginianus Linnaeus

Order Insectivora

Cryptotis cf. *parva* (Say)
Notiosorex cf. *crawfordi* (Coues)
Order Carnivora
Ursus americanus Pallas
Arctotherium simum (Cope)
Canis latrans Say
Aenocyon dirus (Leidy)
Dinobastis serus Cope
Smilodon sp.
Mephitis mephitis (Schreber)
Order Artiodactyla
Bison sp.
Odocoileus virginianus (Zimmerman)
Mylohyus nasutus (Leidy)
Camelid
Order Perissodactyla
Equus sp.
Tapirus sp.
Order Proboscidia
Elephas sp.
Mammut sp.
Order Lagomorpha
Lepus californicus Gray
Sylvalagus audoboni (Baird)
Sylvalagus floridanus (Allen)
Order Edentata
Sloth
Order Rodentia
Sigmodon hispidus Say and Ord
Cynomus ludovicianus (Ord)
Geomys bursarius (Shaw)
Perognathus hispidus Baird
Peromyscus leucopus (Rafinesque)
Peromyscus cf. *maniculatus* (Wagner)
Peromyscus cf. *nasutus* (Allen)
Neotoma floridana (Ord)
Pitymys pinetorum (Le Conte)
Reithrodontomys sp.

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